ROOST SELECTION BY INDIAN PEAFOWL (*PAVO CRISTATUS*) IN GIR FOREST, INDIA[1]

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A study was carried out on roost selection of Indian peafowl (*Pavo cristatus*) in Gir forest, Gujarat. The results revealed that all the roosts were located in the narrow riverine forest belts. Peafowl selected tall trees growing on steep river banks with thorny undergrowth and climber thickets in the canopy for roosting. This clearly indicates that roost selection is chiefly influenced by the risk of predation from nocturnal mammalian predators such as leopard. Trees of *Pongamia pinnata* and *Holoptelia integrifolia* showed more than expected use. However, it could not be confirmed whether a choice at species level does exist at all. Roost selection appeared to be a hierarchial process with structure at first and floristics at second level affecting the choice.

INTRODUCTION

Roost selection is a vital component of the overall habitat selection process. Therefore information on roost selection by a species carries immense importance for assessing its conservation needs. Gadgil and Ali (1975) attempted to explain the communal roosting habits of Indian birds based on the existing hypotheses which include reduced heat loss, information sharing, assessment of population and reduced risk of predation. Though, Indian peafowl (*Pavo cristatus*), a common bird of India is known to roost in the trees at night, no information exists on roost selection by the bird. In a strict sense, it is neither a communal nor a solitary rooster (Trivedi 1993).

This paper attempts to provide information on roost selection by Indian peafowl in a wild landscape. The following results were obtained during a study carried out from November 1992 to April 1993 (Trivedi 1993) on habitat selection by peafowl in Gir forest.

STUDY AREA

The study was carried out in Gir National Park (N.P.) and Sanctuary [(both collectively hereafter referred to as Gir Protected Area (PA)] located in Gujarat, India. Gir PA (1412 sq. km) is the only remaining large, contiguous, forested tract in the Saurashtra peninsula of Gujarat. The PA is covered with tropical dry deciduous forests, thorn forests and riparian forests. The chief floral elements include *Tectona grandis, Diospyros melanoxylon, Wrightia tinctoria, Zizyphus mauritiana, Ficus bengalensis, Morinda tinctoria, Phyllanthus emblica, Bauhinia racemosa, Holoptelia integrifolia, Boswellia serrata* and *Lannea coromandelica.*

The PA is the last stronghold of the Asiatic lion (*Panthera leo persica*) and apart from lion the vertebrate fauna includes leopard (*Panthera pardus*), jackal (*Canis aureus*), jungle cat (*Felis chaus*) and crested hawk eagle (*Spizaetus cirrhatus*) as potential predators of peafowl. Checklist of mammals is available in Spillett (1968). Nearly 250 species of birds have been recorded.

The 'Maldharis' who are local pastoralists and have changed their nomadic lifestyle to a settled one, reside inside the Sanctuary in their settlements called 'ness'. However, N.P. is free from all human activities. Buffalo grazing, tourism, grass harvesting, fireline burning and non-wood forest produce collection are the chief human influences.

METHODS

Eight different localities in three study sites (Sasan, Chhodavdi, Dodhi) were surveyed for roost

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TABLE 1
PREFERENCE INDICES FOR SOME PHYSICAL FEATURES OF ROOST TREES USED BY PEAFOWL

Slope category		Distance to water (in m)		Height (in m)		Height of first branch (in m)	
Class	PI	Class	PI	Class	PI	Class	PI
Very steep	1.45	0-25	1.00	0-10	0.08	0-2	0.61
Steep	0.81	26-50	0.87	11-15	3.38	2.1-4	1.73
Gradual	0.90	51-75	1.08	16-20	6.25	4.1-6	2.57
Flat	0.60	76-100	0.73	21-25	8.10	6.1-8	2.69
--	--	>100	0.73	>25	8.09	8.1-10	3.44

PI= Preference Index.

tree use by peafowl. Both, direct and indirect methods were used to locate and identify the roost trees. The former involved walking along the riparian areas during late evening or early morning, to flush the roosting birds and locate the trees. The latter involved searching for droppings below potential roost trees to identify actual roost trees. When a roost tree was located, GBH, height of the first branch, tree height, slope category of the site where the tree was standing (rated qualitatively as very steep, steep, gradual and flat), distance from water (or water body), canopy and understorey characteristics were recorded. The same data were collected on the ten nearest trees from the roost tree to get availability information. In this manner, use and availability of the trees was determined. A widely used method given by Neu *et al.* (1974) was employed for analysing the availability-use information. Preference index (PI) which is expressed as a ratio of per cent usage to per cent availability was calculated for the structural parameters of roost trees.

RESULTS

1034 trees were quantified as described earlier. Of these 128 were roost trees, which reflected the use, and the remaining gave an idea about the availability. All the roosts were located in riparian areas. Roosts were found to be either continuously spread along the riverine areas or located at the confluence of two streams which is normally a steep area.

Structure: There were differences in the use of trees with and without certain structural features. There was a significant difference between the use of trees with and without thickets of climbers in the canopy (x^2= 10.62, df=1, $p<0.01$). Similarly, there was also a significant difference between the use of trees with and without thorny undergrowth (x^2= 24.61, df=1, $p< 0.001$). In both the cases, trees with thickets of climbers in the canopy and with thorny undergrowth were used more often for roosting. Preference indices (PI) for various structural features are presented in Table 1. Trees on very steep and steep river banks received a higher usage followed by gentler slopes. Trees growing on flat areas were least used for roosting. All tree height categories above 15 metres were highly used, while category <10 metres was used least. Nearly ninety percent of the trees were within 75 metres from water. Trees with 8-10 m high first branch were used more and the use went in a decreasing order towards 0-2 m height.

Floristics: Twenty one plant species were identified as roosts (Appendix 1) of which twenty were trees and one was *Dendrocalamus strictus* (i.e. bamboo). Table 2 shows the availability and use of

TABLE 2
ROOST TREE PREFERENCE OF PEAFOWL
[Using Neu *et al.* (1974) technique]

Tree species	Relative availability	Expected use	Observed use	Confidence intervals
Holoptelia integrifolia	0.051	6.554	18	0.058-0.223**
Tectona grandis	0.124	15.846	14	0.035-0.184
Pongamia pinnata	0.198	25.370	41	0.209-0.431**
Syzygium rubicunda	0.131	16.717	13	0.030-0.173
Tamarindus indica	0.181	23.168	6	0.000-0.097*
Diospyros melanoxylon	0.033	4.224	2	0.000-0.045
Others	0.282	36.096	34	0.161-0.371

* Indicates that the species was used less than availability.
** Indicates that the species was used more than availability.
Rest were used in proportion to availability.
($Z=2.6899$, $X^2 = 45.36$)

major roost trees by peafowl. *Holoptelia integrifolia, Tectona grandis, Pongamia pinnata, Syzygium rubicunda, Tamarindus indica* and *Diospyros melanoxylon* were the commonest tree species available and used as roost by peafowl. Rest of the species were in meagre numbers and therefore these were clumped and collectively called 'others' for analysis. Availability-use analysis of these six species and others showed (Table 2) that only *H. integrifolia* and *P. pinnata* were used more than expected; *T. grandis, S. rubicunda, D. Melanoxylon* and others were used in proportion to availability whereas *T. indica* was used less than its availability.

DISCUSSION

The five most striking features of the roost trees selected by peafowl were; they had climber thickets in the canopy, possessed thorny undergrowth, were on steep river banks, were tall and had a higher first branch. All these features indicate that while selecting a roost tree, the most important aspect is of reducing the risk of predation. In Gallinaceous birds, predation is a major population regulatory mechanism (Lack 1954, Hill and Robertson 1988) and therefore it is likely to influence habitat selection significantly. Selection of trees with the above mentioned features is obviously an antipredatory strategy against nocturnal mammalian predators such as leopard and jungle cat which can climb trees and capture peafowl. In Gir, trees with such features are available only in riverine areas and therefore these forests become crucial for peafowl. The location of roosts at the confluence of two streams was due to the fact that this region is steep and therefore predators would find it difficult to approach from below.

It is pertinent to point out that the height of first branch does not seem to be of significance in roost selection. Similarly, distance from water carries secondary importance as all the roosts are located in the riverine area and one hardly finds a roost >100 m from water. However, trees growing right along the bank with overhanging branches above the river provide ideal roosts as birds are safe from the predators due to water. The vital features, therefore appear to be height of the tree, steepness of the bank/ slope on which the tree is situated and the presence of thickets in the undergrowth and in the canopy. It was realized that height alone can be sufficient for selection if the tree is >16 m. But, if it is shorter than that, the other tree features play a crucial role. In a semi-arid and deciduous forest system such as Gir, trees hardly attain a height of over 15 m and therefore it is the presence of thickets and steepness of the slope that should be of significance in the selection process.

Peafowl in semi-urban and rural landscapes often use unusual substrates as roosts, like electric pylons. Palmyra trees (*Borassus flabellifer*) are commonly used in the Southern districts of Tamil Nadu (pers. obs.). This flexibility probably reflects a synergistic effect of the absence of predation pressure and a low availability of good quality roosts.

Interpretation of the data suggests that it is the structure which is the unit of selection at a broader scale, but at a finer scale, the selection can be for species. Any tree which satisfies the structural requirements for avoiding predators should be selected by the birds. Structure undoubtedly appears to be the first step in roost selection process. It is possible that only certain tree species possess the necessary structural features of an ideal roost tree which means the choice can be at the level of species. The situation seems to be one of a hierarchial selection as described by Svardson (1949), Hilden (1965) and Wiens (1985). However, this is just a logical speculation and no experimental evidence is available to test it. Peafowl (Genus *Pavo*) are regarded as the terminal lineages of peacock pheasants (Geist 1977). *Pavo* left their original rain forest habitat and started exploiting the productive forest-water ecotone (Geist 1977). They gradually advanced to human dominated landscape also, but were always tied to riverine habitats. Roosting on riverine trees might have evolved at the time of their dispersal from climax forests to more xeric environments, because in these habitats only riverine forests can provide good quality roosts.

One more important feature which influences roost selection is the occupancy of trees by other species. It was observed on ten occasions that peafowl did not use particular trees (even when these were ideal for roosting) because common langurs (*Presbytis entellus*) were roosting there. This brings in the question of competition between taxa for a crucial resource, as langurs also roost to avoid predation by leopard. Langurs too, like peafowl are distributed along the riverine areas in Gir (Joslin 1973) and they too roost in riverine forest. However, the magnitude of such potential competition might not be significant. Only one roost tree of chicks was identified which was short (*c.* 10 m) and had extensive thorny thickets wrapped around the stem. With the exception of four trees (out of 128), no roost tree was located close to the road presumably to avoid the disturbance caused by the vehicles.

Peafowl along with common langur are important buffer prey which facilitate the niche separation of leopard and lion in the Gir PA (Ravi Chellam 1993). Both the prey species need to be conserved. Both need roost trees in the riparian areas. In Gir, there is hardly any disturbance to the trees in riverine areas, but incidences of repeated fire can destroy the undergrowth thickets substantially thereby reducing the availability of good quality roosts. At present it is safe to conclude that the population of peafowl in Gir does not face any imminent danger. Our data on roost selection can be used to predict and confirm the use of roosts in other such deciduous forest ecosystems in a wild landscape.

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APPENDIX I

LIST OF SPECIES USED FOR ROOSTING BY PEAFOWL

1. *Holoptelia integrifolia*
2. *Tectona grandis*
3. *Pongamia pinnata*
4. *Syzygium rubicunda*
5. *Tamarindus indica*
6. *Diospyros melanoxylon*
7. *Terminalia bellerica*
8. *T. tomentosa*
9. *Manilkara hexandra*
10. *Syzygium cumini*
11. *Ficus glomerata*
12. *F. bengalensis*
13. *Miliusa tomentosa*
14. *Mitragyna parviflora*
15. *Garuga pinnata*
16. *Sterculia urens*
17. *Acacia senegal*
18. *Anogeissus latifolia*
19. *Phoenix sylvestris*
20. *Dendrocalamus strictus*
21. *Sapindus emarginatus*